South Dakota’s Forest Resources in 2005

Ronald J. Piva, Douglas Haugan, Gregory J. Josten, and Gary J. Brand
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Results of the 2005 annual inventory of South Dakota show 1.7 million acres of forest land in the State. Timberland accounted for more than 90 percent of the forest land area. More than 70 percent of the timberland is publicly owned. Eighty percent (1.2 billion cubic feet) of the growing-stock volume on timberland came from ponderosa pine. All live aboveground tree biomass on timberland totaled 30.3 million dry tons. Major insect problems in South Dakota’s forests were the mountain pine beetle and the pine engraver beetle.

KEY WORDS: Annual inventory, forest land, timberland, forest type, volume, biomass, forest health, South Dakota.
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South Dakota’s Forest Resources in 2005

The North Central Research Station’s Forest Inventory and Analysis program (NCFIA) began fieldwork for the fifth forest inventory of South Dakota’s forest resources in 2001. This inventory initiated the new annual inventory system in which one-fifth of the field plots (considered one panel) in the State are measured each year. A complete inventory consists of measuring and compiling the data for all plots in all five panels. Once all panels have been measured, each will be remeasured approximately every 5 years. For example, in South Dakota, the field plots measured in 2005 will be remeasured in 2010.

In 2005, NCFIA completed the annual inventory effort with the last of five panels of the fifth forest inventory of South Dakota’s forest resources. Data presented in this report represent 100 percent of the field plots (or all five panels) for a complete inventory and are a combination of the first year’s panel from 2001 through the fifth year’s panel from 2005. Earlier reports for the 2001 panel (Leatherberry and Haugan 2003), the 2002 panel (Piva et al. 2003), the 2003 panel (Piva et al. 2005), and the 2004 panel (Piva et al. 2006) have also been published and are available only on line at: http://www.ncrs.fs.fed.us. Results presented are estimates based on sampling techniques; estimates were compiled assuming the 2001, 2002, 2003, 2004, and 2005 data represent one sample.

Reports of previous inventories of South Dakota are dated 1935, 1962, 1984, and 1996. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several procedures and definitions have changed since the last South Dakota inventory in 1996 (Leatherberry et al. 2000).

The most important change is the border-to-border inventory of forest resources in South Dakota. Before 1996, both the NCFIA and the Interior West FIA (IWFIA) (formerly the Intermountain FIA program) in Ogden, UT, inventoried South Dakota’s forest resources. NCFIA inventoried that portion of the State east of the 103rd meridian. IWFIA inventoried western South Dakota (west of the 103rd meridian), including the Black Hills National Forest (BHNF). In 1996, NCFIA inventoried all of South Dakota except for the BHNF, which was inventoried by IWFIA in 1999 (DeBlander 2002). The portion of the Custer National Forest that is in South Dakota was inventoried again by IWFIA in 1997 (DeBlander 2001).

Because different designs and methods have been employed in various South Dakota inventories, a comparison of the 2005 data with data from earlier inventories should be interpreted with caution. Where comparisons are made with data from past inventories, they are done only to suggest the direction of change. For this report, the information for South Dakota’s previous inventory is a combination of the 1996 inventory by NCFIA of all lands outside the BHNF and the 1999 inventory by IWFIA of the BHNF. The combined information was obtained from the Forest Inventory Mapmaker Web site located at: http://www.ncrs2.fs.fed.us/4801/FIADB/index.htm.

RESULTS

Area

In 2005, there were an estimated 1.7 million acres of forest land in South Dakota, accounting for a little more than 3 percent of the State’s total land area. Forest land is land at

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least 10 percent stocked by forest trees of any size or formerly having had such tree cover and not currently developed for nonforest use. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Seventy-one percent, or almost 1.2 million acres, of the forest land in the State was publicly owned (table 1). Most of the public land in the State is west of the Missouri River.

There are three major areas of natural forests in South Dakota (Ball and Erickson 1998). The Black Hills forest is the largest area of forest land in the State. This forested area is composed primarily of ponderosa pine, but also includes quaking aspen, Black Hills spruce (a variety of white spruce), paper birch, and bur oak. The second largest area is the flood plain forests along the Missouri River. American elm and green ash are the major species found in these forests. Bur oak forests along the upper terraces and draws of rivers and in the northern Black Hills account for the third largest area in the State. Other forested areas in South Dakota are the cottonwood forests scattered along the rivers and streams throughout the State and the maple and basswood forests of the upland forests on the eastern side of the State.

Timberland accounted for 92 percent, or 1.6 million acres, of the forest land in South Dakota in 2005. Timberland is forest land that is producing, or is capable of producing, 20 cubic feet of wood per acre per year under natural conditions and is not restricted from harvest. Throughout most of the 20th century, the area of timberland in South Dakota remained relatively stable, rising and falling between 1.5 and 1.7 million acres (fig. 1). Seventy-two percent of the timberland in the State is publicly owned (table 2). The USDA Forest Service, through the Black

Figure 1.—Area of timberland, South Dakota, 1935-2005. (Note: The 1935 area may contain some area of forest land that is not timberland. Sample errors and confidence intervals are not provided for the 1935 and 1984 inventories because no single statewide sample error is available for those inventories. The 1962 and 2005 estimates are for total timberland area; the sample error associated with the 1996 estimate is calculated for timber area outside of the BHNF. Confidence intervals are represented by the vertical line at the top of each bar and represent the 67-percent confidence level.)
Hills and Custer National Forests, holds the majority of public timberland. Private forest landowners account for 28 percent of the timberland ownership. This privately owned timberland is dominated by parcels of less than 100 acres in size (Leatherberry et al. 2000). Those holdings are generally associated with farms or ranches. Native American tribal groups own an estimated 93 thousand acres of timberland held as tribal trust land within the boundaries of reservations in South Dakota (Haugen and Hansen 2002).

The ponderosa pine forest type accounted for 70 percent of the total timberland area in South Dakota in 2005 (fig. 2). Overall, softwood forest types accounted for 77 percent of the total timberland area in the State. The elm/ash/cottonwood forest type group occupied the second largest area of timberland, but accounted for only 7 percent of the total.

Although virtually all of the timberland area in South Dakota is of natural origin, South Dakota residents have a long history of planting trees. Most of these plantings are associated with windbreaks, shelterbelts, or farmstead plantings and do not meet the area or width requirements to be classified as timberland. Many of the earlier efforts to establish tree plantations failed or were later abandoned.

As South Dakota’s forests mature and are affected by natural and human-caused events, they take on certain stand-size characteristics. Stand-size class is a measure of the average diameter of the dominant trees in a stand. There are four stand-size classes: (1) sawtimber—large trees, softwoods at least 9 inches in diameter at breast height (diameter at 4.5 feet above ground level, commonly referred to as d.b.h.) and hardwoods at least 11 inches d.b.h.; (2) poletimber—medium trees 5 inches in d.b.h. to sawtimber size; (3) sapling-seedling—small trees, softwoods at least 6 inches tall and hardwoods at least 1 foot tall, to poletimber size; and (4) nonstocked stands—timberland less than 10 percent stocked in all-live trees. In 2005, sawtimber stands occupied 1 million acres of timberland, or 66 percent

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**Figure 2.**—Area of timberland by forest type group, South Dakota, 2005.
of the timberland area (table 3). Poletimber-
size stands accounted for 15 percent of the
timberland area, followed by
sapling/seedling stands on 12 percent of
timberland area. Nonstocked timberland
occupied more than 6 percent of the total
timberland area, mainly in the Black Hills
area of the State. The predominance of saw-
timber-size stands reflects the presence of
larger diameter ponderosa pine in the
BHNF and older, large-diameter bottomland
hardwood stands.

Since South Dakota’s forest inventory in
1996 and the BHNF inventory in 1999, the
area of sawtimber-size stands has increased
by 160 thousand acres (fig. 3). The area of
poletimber-size stands and seedling-sapling-
size stands has decreased by more than 50
thousand acres and almost 165 thousand
acres, respectively. The area of nonstocked
stands has increased by almost 75 thousand
acres. Many of these nonstocked areas are
the result of recent forest fires.

Volume

South Dakota’s net volume of all-live trees on
forest land totaled 1.7 billion cubic feet (table
4). Almost three-fourths of this volume is pon-
derosa pine. All the hardwood species com-
bined accounted for only 20 percent of the
total volume of all-live trees on forest land.
Net cubic and board foot volumes are based
on tree measurements (d.b.h., tree class, and
site index) and volume models presented by
Hahn and Hansen (1991). The models were
regionally adjusted by applying cull factors
computed from trees measured in the 1996
inventories of the Plains States.

Growing-stock trees on timberland accounted
for more than 85 percent (1.5 billion cubic
feet) of the live-tree volume on forest land. A
growing-stock tree is a 5.0-inch d.b.h. or larg-
er, live tree of commercial species that meets
specified standards of size, quality, and mer-
chantability. Besides growing-stock volume,
there were an additional 122 million cubic feet

Figure 3.—Area of timberland by stand-size class, South Dakota, 1996 and 2005.
(Confidence intervals are represented by the vertical line at the top of each bar and repre-
sent the 67-percent confidence level.)
in live cull trees (trees 5.0 inches d.b.h. or larger and unmerchantable for saw logs now or prospectively because of rot, roughness, or species) and 5 million cubic feet of salvable dead trees (trees downed or standing dead that were 5.0 inches d.b.h. or larger and contained at least one 8-foot section that was at least 50 percent sound) on timberland in South Dakota in 2005 (table 5). More than 70 percent of the live cull volume on timberland came from hardwood species. All of the salvable dead volume on timberland came from softwood species.

The softwood forest type groups contained more than 85 percent of the State’s growing-stock volume (table 6). Ponderosa pine accounted for 80 percent (1.2 billion cubic feet) of the growing-stock volume on timberland (fig. 4 and table 7). Between 1996 and 2005, ponderosa pine and spruce growing-stock volumes decreased in South Dakota because of disturbances such as insect infestations, wildfires, and severe weather. As eastern redcedar becomes established on rangeland and farmland set aside for conservation, the volume of growing stock appears to be increasing.

There were 5.6 billion board feet of sawtimber in South Dakota (table 8). Sawtimber volume is the volume of wood in the saw log portion of sawtimber-size trees. Fifty-five percent of the sawtimber volume came from sawtimber-size trees less than 15 inches d.b.h.

**Biomass**

All live aboveground tree biomass on timberland in South Dakota was estimated at 30.3 million dry tons in 2005 (table 9) or an average of almost 20 dry tons of biomass per acre. Biomass is the amount of total wood and bark (excluding foliage) of trees 1.0 inch in d.b.h or larger, including all tops and limbs. The dry tons estimate of biomass is an important measure because it provides information that can be used for analyses related to carbon sequestration, wood fiber availability for fuel, and other uses. In 2005, 85 percent of the total biomass came from growing-stock trees, 5 percent came from saplings between 1.0 and 5.0 inches d.b.h., and 10 percent came from non-growing-stock trees (cull trees and noncommercial species).

**Forest Health**

Although South Dakota is mostly prairie and cropland, forests are an important component of the landscape. Currently, the primary forest health concerns for South Dakota’s forests are
drought, mountain pine beetle, pine engraver beetle, banded elm beetle, two-lined chestnut borer, and the establishment of the nonnative salt cedar plant. More information about forest health issues that have affected South Dakota forests since the last complete forest inventory and more information about current events are available at the National Forest Health Monitoring (FHM) Web site at http://fhm.fs.fed.us/ and at the Rocky Mountain Forest Health Monitoring Web site at http://www.fs.fed.us/r2/fhm/.

**SUMMARY**

In summary, estimates of South Dakota's forest resources indicate timberland area has remained relatively stable at about 3 percent of the total land area. Ponderosa pine, found mostly in the Black Hills region, is the predominant forest type group. Eastern redcedar appears to be expanding in the State, but it is still a minor portion of the total area and volume. As additional data become available from ensuing annual inventories, a clearer picture of the direction of South Dakota's forests will emerge. Additional data related to the two most recent inventories of South Dakota (1980 and 1996) are available at: www.ncrs2.fs.fed.us/4801/fiadb/index.htm.
APPENDIX

Inventory Methods

Since the 1996 inventory of South Dakota’s forest outside the BHNF, several changes have been made in NCFIA inventory methods to improve the quality of the inventory as well as meet increasing demands for timely forest resource information. The most significant difference between inventories is the change from periodic inventories to annual inventories. Historically, NCFIA periodically inventoried each State on a cycle that averaged about 12 years. However, the need for timely and consistent data across large regions, combined with national legislative mandates, resulted in NCFIA’s implementation of an annual inventory system. The annual inventory system began in South Dakota in 2001. At that time, the NCFIA program assumed responsibility for inventorying all forest lands in South Dakota.

With the NCFIA annual inventory system, approximately one-fifth of all field plots are measured each year. After 5 years, the entire inventory cycle will be completed. After the initial 5-year cycle, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 2001 through 2005 or for 2002 through 2006. Sampling error estimates for the 2005 inventory results are area of forest land, 3.3 percent; area of timberland, 3.6 percent; volume of growing stock on timberland, 5.1 percent; and volume of sawtimber on timberland, 5.8 percent. All conclusions based on this inventory must be tempered by the sampling errors that correspond with all estimates from this inventory.

Other significant changes between inventories include new remote sensing technology, use of a new sampling design, and a new field plot configuration. The advent of remote sensing technology since the previous inventory in 1996 has allowed NCFIA to use Multi-Resolution Land Characterization (MRLC) data and other available remote sensing products to stratify the total area of the State and to improve the precision of estimates. Previous inventories used manual interpretation of aerial photos to stratify the sample.

New algorithms were used in 2005 to assign forest type and stand-size class to each condition observed on a plot (Bechtold and Patterson 2005). FIA is using these algorithms nationwide to increase consistency among States. The list of recognized forest types, grouping of these forest types for reporting purposes, models used to assign stocking values to individual trees, definition of non-stocked, and names given to the forest types have all changed. As a result, some comparisons between the 1996 inventory results and those published for the 2005 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Sampling Phases

The 2005 South Dakota survey was conducted in three phases. The first phase used classified satellite imagery to stratify the State and aerial photographs to select plots for field measurement. The second phase measured the traditional FIA suite of mensurational variables, and the third phase focused on a suite of variables related to forest health.

The only land that could not be sampled was (1) private land where field personnel could not obtain permission from the owner to measure the field plot and (2) plots that could not be accessed because of a hazard or danger to field personnel. The methods used in the preparation of this report make the necessary adjustments to account for sites where access was denied or hazardous. There were 17 denied access or hazardous plots encountered in the first five inventory panels.
Phase 1
The 2005 South Dakota inventory used a classification of 30-m Landsat Thematic Mapper satellite imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest edge formed two additional strata—forest edge and nonforest edge. Forest pixels within 60 m on the forest side of a forest-nonforest boundary were classified into a forest edge stratum. Pixels within 60 m of the boundary on the nonforest side were classified into a nonforest edge stratum. The estimated population total for a variable is the sum across all strata of the product of each stratum’s estimated area and the variable’s estimated mean per unit area for the stratum. Stratification and estimation were conducted at the NCFIA Forest Survey Unit level. All private land and the BHNF were stratified into one of the four strata: (1) nonforest, (2) nonforest edge, (3) forest, or (4) forest edge. The Custer National Forest was stratified into one of two strata: (1) nonforest and nonforest edge combined, or (2) forest and forest edge combined. All the other public land in South Dakota was stratified into one of three strata: (1) nonforest, (2) nonforest edge, or (3) forest and forest edge combined.

In the 1996 South Dakota inventory outside the BHNF, photointerpreters at NCFIA assembled aerial photographs into township mosaics, and a systematic grid of 121 one-acre photo plots (each dot representing approximately 190.4 acres on the ground) was overlaid on each township mosaic. Each of these photo plots was stereoscopically examined and classified based on land use, forest type, stand size, and density. From these photo plots, a systematic sample of plots (without regard to their aerial photo classification) were selected as ground plots and further examined by survey crews to verify the classification and to take further measurements. Additional information related to the procedures for the 1996 South Dakota inventory can be found in Leatherberry et al. (2000), and procedures for the 1999 BHNF inventory by IWFIA can be found in DeBlander (2002) and USDA Forest Service (1999).

The increased intensity of the phase 1 sample greatly improved estimates of the area within each stratum, particularly at the county level. Additionally, because the classification was conducted across the entire State, biases in the photo plot sampling method that resulted from differences in photo quality, age of photography, and experience of the photointerpreter were minimized and classification was consistent across the entire State.

Phase 2
Phase two of the inventory consisted of the measurement of the first annual sample of field plots in South Dakota and the remeasurement of inventory plots from the 1999 BHNF inventory (DeBlander 2002). Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has established a plot array that divides the entire area of the United States into nonoverlapping hexagons, each of which contains approximately 5,937 acres (McRoberts 1999). An array of field plots was established by selecting one plot from each hexagon based on the following rules: (1) if an IWFIA plot from the 1999 inventory of the BHNF fell within a hexagon, it was selected; (2) if more than one IWFIA plot from the 1999 inventory of the BHNF fell within a hexagon, the plot nearest the hexagon center was selected; and (3) if no existing IWFIA plots fell within the hexagon, and for all area outside the BHNF, a new NCFIA plot was established in the hexagon (McRoberts 1999). This array of plots is designated the Federal base sample and is considered an equal probability sample; its measurement in South Dakota is funded by the Federal government.

The total Federal base sample was systematically divided into five interpenetrating, nonoverlapping subsamples or panels. Each year the plots in a single panel are measured, and panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel of plots may be considered an independent systematic sample of all land in a State. Field crews measure vegetation on plots currently classified as forested or forest edge by trained photointerpreters using aerial photos or digital orthophotoquads. A sample of plots classified as nonforest was checked to ensure correct classification.
Phase 3

NCFIA has two categories of field plot measurements—phase 2 plots (standard FIA plots) and phase 3 plots (forest health plots). Both types of plot are systematically distributed both geographically and temporally. Phase 3 plots are measured with the full array of FHM vegetative and health variables (Mangold 1998) collected as well as the full suite of measures associated with phase 2 plots. Phase 3 plots must be measured between June 1 and August 30 to accommodate the additional measurement of nonwoody understory vegetation, ground cover, soils, and other variables.

In South Dakota, the complete 5-year annual inventory included the classification of 520 phase 3 plots, of which 26 had field measurements. On the remaining plots, referred to as phase 2 plots, only variables that can be measured throughout the entire year were collected. The complete 5-year annual inventory of South Dakota included the classification of 8,303 phase 2 plots. The 2001-2005 annual panel results represent field measures on 297 timberland plots, 28 other forest land plots, 17 denied access and hazardous plots, and 7,961 non-forest land plots.

The new national FIA plot configuration with four subplots (fig. 5) was first used for data collection in South Dakota in the BHNF in 1999 and for the rest of the State during the 2001 panel. This design was used for the remaining four panels, 2002-2005 and will be used in subsequent years. On forest land outside the BHNF, all plots in the annualized inventory are newly established; therefore, some remeasurement data will not be available until the sixth year of the annual inventory. These measurements form the basis for change estimates between the first five-panel cycle and the second five-panel cycle for characteristics such as average annual net growth, mortality, and removals. The national plot design requires mapping forest conditions on each plot. Due to the small sample size (20 percent) each year, precision associated with change factors such as mortality will be relatively low.

Consequently, change estimates outside the BHNF may not be reported until at least the third annual panel of the second five-panel cycle of inventory has been implemented, and even then we anticipate that detailed estimates of change will be subject to high sampling error. When the second cycle of plots has been completed in 2010, the full range of change variables will be available for the entire State.

The overall plot layout for the new design consists of four subplots. The centers of subplots 2, 3, and 4 are located 120 feet from the center of subplot 1. The azimuths to subplots 2, 3, and 4 are 0, 120, and 240 degrees, respectively. For remeasurement plots from the 1999 inventory of the BHNF, the center of the plot is located at the same point as the center of the previous plot. Trees with diameter at breast height or diameter at the root collar (d.r.c.) at least 5 inches for woodland species such as Rocky Mountain juniper, are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees less than 5 inches d.b.h/d.r.c. are measured on a 6.8-foot-radius (1/300 acre) circular microplot located 12.0 feet due east of the center of each of the four subplots. Forest conditions that occur on any of the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, land use, ownership, and density.
Each condition is identified, described, and mapped if the area of the condition meets or exceeds 1 acre in size.

Field plot measurements are combined with phase 1 estimates in the compilation process and table production. The number of tables generated for this report is limited. However, at http://ncrs2.fs.fed.us/4801/fiadb/fim17/wcfim17.asp other tabular data can be generated. For additional information, contact:

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South Dakota’s forest resources outside


Joint annual forest inventory and monitoring sys-

Table 1.—Area of forest land by forest type group, forest type, and owner category, South Dakota, 2001-2005

Table 2.—Area of timberland by major forest type group, stand origin, and owner category, South Dakota, 2001-2005

Table 3.—Area of timberland by forest type group, forest type, and stand-size class, South Dakota, 2001-2005

Table 4.—Net volume of all live trees on forest land by species group, species, and owner category, South Dakota, 2001-2005

Table 5.—Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood species category, South Dakota, 2001-2005

Table 6.—Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, South Dakota, 2001-2005

Table 7.—Net volume of growing stock on timberland by species group, species, and diameter class, South Dakota, 2001-2005

Table 8.—Net volume of sawtimber on timberland by species group, species, and diameter class, South Dakota, 2001-2005

Table 9.—All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, South Dakota, 2001-2005

TABLES
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<td>Maple / beech / birch group</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Elm / ash / locust</td>
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<tr>
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<td>4.8</td>
<td>63.6</td>
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<tr>
<td>Aspen / birch group</td>
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<td>Aspen</td>
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<td>4.3</td>
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<td>-</td>
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<tr>
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</tr>
<tr>
<td>Other exotic hardwoods</td>
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<td>10.8</td>
<td>-</td>
</tr>
<tr>
<td>All forest types</td>
<td></td>
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</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the acres round to less than 0.1 thousand acres. Columns and rows may not add to their totals due to rounding.
Table 2. -- Area of timberland by major forest type group, stand origin, and owner category, South Dakota, 2001-2005

(In thousand acres)

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<th>Major forest type group and stand origin</th>
<th>Owner category</th>
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<tr>
<td>Hardwood type groups</td>
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<tr>
<td>Natural</td>
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<td>Planted</td>
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<tr>
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All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the acres round to less than 0.1 thousand acres. Columns and rows may not add to their totals due to rounding.
## Table 3. -- Area of timberland by forest type group, forest type, and stand-size class, South Dakota, 2001-2005

(In thousand acres)

<table>
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<tr>
<th>Forest type group/forest type</th>
<th>Stand-size class</th>
<th>All stands</th>
<th>Sawtimber</th>
<th>Poletimber</th>
<th>Sapling-seedling</th>
<th>Non-stocked</th>
</tr>
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<tbody>
<tr>
<td>Softwood type groups</td>
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<td></td>
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</tr>
<tr>
<td>Spruce / fir group</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>White spruce</td>
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<td>42.4</td>
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<td>7.5</td>
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<tr>
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<td>56.0</td>
<td>42.4</td>
<td>6.1</td>
<td>7.5</td>
<td>--</td>
</tr>
<tr>
<td>Pinyon / juniper group</td>
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<td></td>
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<tr>
<td>Eastern redcedar</td>
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<td>11.3</td>
<td>11.3</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Rocky Mountain juniper</td>
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<td>18.5</td>
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<td>1.0</td>
<td>6.7</td>
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<td>22.3</td>
<td>1.0</td>
<td>6.7</td>
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</tr>
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<td>Ponderosa pine group</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ponderosa pine</td>
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<td>853.1</td>
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<td>853.1</td>
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</tr>
<tr>
<td>Oak / hickory group</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Bur oak</td>
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<td>20.0</td>
<td>10.4</td>
<td>9.6</td>
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<tr>
<td>Mixed upland hardwoods</td>
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<td>14.7</td>
<td>15.0</td>
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<td>Elm / ash / cottonwood group</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Cottonwood</td>
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<td>30.1</td>
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<td>--</td>
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<tr>
<td>Sugarberry / hackberry / elm / green ash</td>
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<td>66.8</td>
<td>45.1</td>
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<td>13.4</td>
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<tr>
<td>Cottonwood / willow</td>
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<td>4.3</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Elm / ash / locust</td>
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<td>44.3</td>
<td>11.1</td>
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<td>11.6</td>
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<td></td>
</tr>
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<td>46.1</td>
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<tr>
<td>Paper birch</td>
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<td>--</td>
<td>4.3</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Other exotic hardwoods</td>
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<td>10.8</td>
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<tr>
<td>All forest types</td>
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<td>--</td>
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<td>98.5</td>
</tr>
<tr>
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<td>1,552.4</td>
<td>1,028.9</td>
<td>234.7</td>
<td>190.3</td>
<td>98.5</td>
</tr>
</tbody>
</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the acres round to less than 0.1 thousand acres. Columns and rows may not add to their totals due to rounding.
Table 4. -- Net volume of all live trees on forest land by species group, species, and owner category, South Dakota, 2001-2005

(In thousand cubic feet)

<table>
<thead>
<tr>
<th>Species group/species</th>
<th>All owners</th>
<th>Public</th>
<th>Private</th>
<th>Unidentified owner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Softwoods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spruce and balsam fir</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White spruce</td>
<td>82,236</td>
<td>80,171</td>
<td>2,065</td>
<td>-</td>
</tr>
<tr>
<td>All species</td>
<td>82,236</td>
<td>80,171</td>
<td>2,065</td>
<td>-</td>
</tr>
<tr>
<td><strong>Other eastern softwoods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocky Mountain juniper</td>
<td>24,575</td>
<td>21,028</td>
<td>3,547</td>
<td>-</td>
</tr>
<tr>
<td>Eastern redcedar</td>
<td>7,522</td>
<td>793</td>
<td>6,729</td>
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</tr>
<tr>
<td>Ponderosa pine</td>
<td>1,240,066</td>
<td>1,049,522</td>
<td>190,544</td>
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<td>1,071,343</td>
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<tr>
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<td>97,007</td>
<td>18,046</td>
<td>78,961</td>
<td>-</td>
</tr>
<tr>
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<td>18,046</td>
<td>78,961</td>
<td>-</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Sugar maple</td>
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<td>776</td>
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</tr>
<tr>
<td>All species</td>
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<td>776</td>
<td>-</td>
</tr>
<tr>
<td><strong>Soft maple</strong></td>
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<td>Silver maple</td>
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<td>3,150</td>
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</tr>
<tr>
<td><strong>Ash</strong></td>
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<tr>
<td>Green ash</td>
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<td>1,734</td>
<td>70,451</td>
<td>-</td>
</tr>
<tr>
<td>All species</td>
<td>72,185</td>
<td>1,734</td>
<td>70,451</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cottonwood and aspen</strong></td>
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</tr>
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<td>Quaking aspen</td>
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(Table 4 continued on next page)
(Table 4 continued)

<table>
<thead>
<tr>
<th>Species group/ species category</th>
<th>Owner category</th>
<th>All owners</th>
<th>Public</th>
<th>Private</th>
<th>Unidentified owner</th>
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<tbody>
<tr>
<td>Hardwoods</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Basswood</td>
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</tr>
<tr>
<td>American basswood</td>
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<td>615</td>
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<tr>
<td>All species</td>
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<td>615</td>
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<tr>
<td>Other eastern soft hardwoods</td>
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<td>25,876</td>
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<td>3,900</td>
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<td></td>
</tr>
<tr>
<td>Red mulberry</td>
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<td>-</td>
</tr>
<tr>
<td>All species</td>
<td></td>
<td>324</td>
<td>324</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Eastern noncommercial hardwoods</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Prairie crab apple</td>
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<td>130</td>
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<td>130</td>
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<tr>
<td>Eastern hop hornbeam</td>
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<td>277</td>
<td>1,102</td>
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<td>Chokecherry</td>
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<td>40</td>
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<tr>
<td>Willow spp.</td>
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<td>780</td>
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<tr>
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<td>2,330</td>
<td>277</td>
<td>2,052</td>
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<td>1,699,855</td>
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</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.
Table 5: Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood species category, South Dakota, 2001-2005

(In thousand cubic feet)

<table>
<thead>
<tr>
<th>Class of timber</th>
<th>All species</th>
<th>Softwood species</th>
<th>Hardwood species</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Live trees</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Growing-stock trees</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sawtimber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saw log portion</td>
<td>1,004,635</td>
<td>894,278</td>
<td>110,358</td>
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<tr>
<td>Upper stem portion</td>
<td>143,394</td>
<td>130,023</td>
<td>13,371</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,148,030</td>
<td>1,024,301</td>
<td>123,729</td>
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<tr>
<td>Poletimber</td>
<td>314,811</td>
<td>233,647</td>
<td>81,164</td>
</tr>
<tr>
<td><strong>All growing-stock trees</strong></td>
<td>1,462,840</td>
<td>1,257,948</td>
<td>204,893</td>
</tr>
<tr>
<td><strong>Cull trees</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough trees(^1)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sawtimber size</td>
<td>86,933</td>
<td>24,829</td>
<td>62,104</td>
</tr>
<tr>
<td>Poletimber size</td>
<td>26,819</td>
<td>8,067</td>
<td>18,752</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>113,752</td>
<td>32,897</td>
<td>80,856</td>
</tr>
<tr>
<td>Rotten trees(^1)</td>
<td></td>
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</tr>
<tr>
<td>Sawtimber size</td>
<td>6,498</td>
<td>544</td>
<td>5,955</td>
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<tr>
<td>Poletimber size</td>
<td>1,400</td>
<td>-</td>
<td>1,400</td>
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<tr>
<td><strong>Total</strong></td>
<td>7,898</td>
<td>544</td>
<td>7,355</td>
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<td><strong>All live cull trees</strong></td>
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<td>88,210</td>
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<tr>
<td><strong>All live trees</strong></td>
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<td>293,103</td>
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<td><strong>Salvable dead trees</strong></td>
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<tr>
<td>Sawtimber size</td>
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<tr>
<td>Poletimber size</td>
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<td><strong>All salvable dead trees</strong></td>
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<td><strong>All classes</strong></td>
<td>1,589,253</td>
<td>1,296,150</td>
<td>293,103</td>
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</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

\(^1\) Includes noncommercial species.
Table 6. — Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, South Dakota, 2001-2005

(In thousand cubic feet)

<table>
<thead>
<tr>
<th>Forest type group/forest type</th>
<th>All species</th>
<th>Softwood species</th>
<th>Hardwood species</th>
</tr>
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<tbody>
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<td><strong>Softwood type groups</strong></td>
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</tr>
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<td>Spruce / fir group</td>
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<td>69,401</td>
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<tr>
<td>All forest types</td>
<td>72,607</td>
<td>69,401</td>
<td>3,206</td>
</tr>
<tr>
<td>Pinyon / juniper group</td>
<td></td>
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<tr>
<td>Eastern redcedar</td>
<td>4,164</td>
<td>4,164</td>
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<tr>
<td>Rocky Mountain juniper</td>
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<td>244</td>
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<td>All forest types</td>
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<tr>
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<td>1,159,734</td>
<td>17,620</td>
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<td>1,159,734</td>
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<tr>
<td><strong>All softwood groups</strong></td>
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<td></td>
<td>1,254,369</td>
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<td><strong>Hardwood type groups</strong></td>
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<td>Oak / hickory group</td>
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<tr>
<td>All forest types</td>
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<td>11,159</td>
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<tr>
<td>Elm / ash / cottonwood group</td>
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<tr>
<td>Cottonwood</td>
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<td>61,473</td>
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<td>Maple / beech / birch group</td>
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<tr>
<td>Elm / ash / locust</td>
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<td>1,169</td>
<td>22,048</td>
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<tr>
<td>All forest types</td>
<td>23,217</td>
<td>1,169</td>
<td>22,048</td>
</tr>
<tr>
<td>Aspen / birch group</td>
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<td>Paper birch</td>
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<td>8,711</td>
<td>11,808</td>
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<td>Exotic hardwoods group</td>
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<tr>
<td>Other exotic hardwoods</td>
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<tr>
<td>All forest types</td>
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<td>- -</td>
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<tr>
<td><strong>All hardwood groups</strong></td>
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<td>205,160</td>
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<td>3,311</td>
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<tr>
<td><strong>All forest groups</strong></td>
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<tr>
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<td>1,462,840</td>
<td>1,257,948</td>
<td>204,893</td>
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</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.
### Table 7. Net volume of growing stock on timberland by species group, species, and diameter class, South Dakota, 2001-2005

<table>
<thead>
<tr>
<th>Diameter Class (inches at breast height)</th>
<th>All species classes</th>
<th>Softwoods</th>
<th>White spruce</th>
<th>Spruce and balsam fir</th>
<th>Rocky Mountain juniper</th>
<th>Eastern redcedar</th>
<th>Eastern cottonwood</th>
<th>Quaking aspen</th>
<th>Other eastern soft hardwoods</th>
<th>Other eastern hard hardwoods</th>
<th>All species groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0-10.9</td>
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<td>17.0-18.9</td>
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<td>19.0-20.9</td>
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</tbody>
</table>

Note: All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.
Table 8. -- Net volume of sawtimber on timberland by species group, species, and diameter class, South Dakota, 2001-2005

(In thousand board feet)

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</thead>
<tbody>
<tr>
<td><strong>Softwoods</strong></td>
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<tr>
<td>Spruce and balsam fir</td>
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</tr>
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<td>23,255</td>
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<tr>
<td>Other eastern softwoods</td>
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<tr>
<td>Rocky Mountain juniper</td>
<td>All species</td>
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<tr>
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<td>916,168</td>
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<td>All species</td>
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<td>3,896</td>
<td>5,695</td>
<td>8,764</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American elm</td>
<td>All species</td>
<td>19,411</td>
<td></td>
<td></td>
<td></td>
<td>8,292</td>
<td>6,205</td>
<td>4,914</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total hardwoods</strong></td>
<td>All species</td>
<td>589,455</td>
<td></td>
<td></td>
<td></td>
<td>8,292</td>
<td>6,205</td>
<td>4,914</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All species groups</strong></td>
<td>All species</td>
<td>5,596,501</td>
<td>990,214</td>
<td>1,043,228</td>
<td>1,025,594</td>
<td>821,052</td>
<td>655,283</td>
<td>420,909</td>
<td>491,917</td>
<td>148,304</td>
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</tr>
</tbody>
</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the volume rounds to less than 1 thousand board feet. Columns and rows may not add to their totals due to rounding.

1 International 1/4-inch rule.
Table 9. -- All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, South Dakota, 2001-2005

(In thousand dry tons)

<table>
<thead>
<tr>
<th>Owner category and softwood/hardwood category</th>
<th>Tree biomass component</th>
<th>All live 1-5 inch trees</th>
<th>Growing-stock trees</th>
<th>Non-growing-stock trees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All components</td>
<td>Total</td>
<td>Boles</td>
<td>Stumps, tops, and limbs</td>
</tr>
<tr>
<td>Public</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softwoods</td>
<td>18,770</td>
<td>17,534</td>
<td>14,444</td>
<td>3,090</td>
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<tr>
<td>Hardwoods</td>
<td>1,565</td>
<td>1,045</td>
<td>746</td>
<td>299</td>
</tr>
<tr>
<td>Total</td>
<td>20,335</td>
<td>18,578</td>
<td>15,190</td>
<td>3,389</td>
</tr>
<tr>
<td>Private</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softwoods</td>
<td>3,521</td>
<td>3,234</td>
<td>2,679</td>
<td>555</td>
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<tr>
<td>Hardwoods</td>
<td>6,439</td>
<td>3,815</td>
<td>2,741</td>
<td>1,074</td>
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<tr>
<td>Total</td>
<td>9,960</td>
<td>7,049</td>
<td>5,421</td>
<td>1,629</td>
</tr>
<tr>
<td>All ownerships</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Softwoods</td>
<td>22,291</td>
<td>20,768</td>
<td>17,123</td>
<td>3,645</td>
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<tr>
<td>Hardwoods</td>
<td>8,004</td>
<td>4,860</td>
<td>3,488</td>
<td>1,372</td>
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<tr>
<td>Total</td>
<td>30,295</td>
<td>25,628</td>
<td>20,611</td>
<td>5,017</td>
</tr>
</tbody>
</table>

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the aboveground tree biomass rounds to less than 1 thousand dry tons. Columns and rows may not add to their totals due to rounding.
Capitalizing on the strengths of existing science capacity in the Northeast and Midwest to attain a more integrated cohesive landscape scale research program